SW & HW PER AUTOMAZIONE

REG. N. 3583
UNI EN ISO 9001:2000

EMUFDD 4.24 – User Manual

The most featured and configurable Universal Floppy HW Emulator

All-inclusive professional installation service available

Custom/Non-standard floppies analysis & development available

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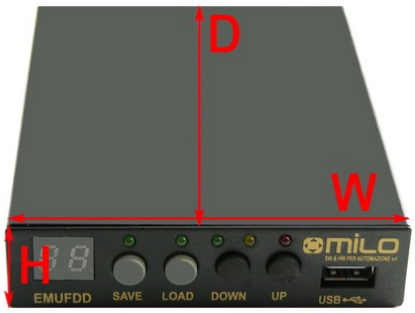
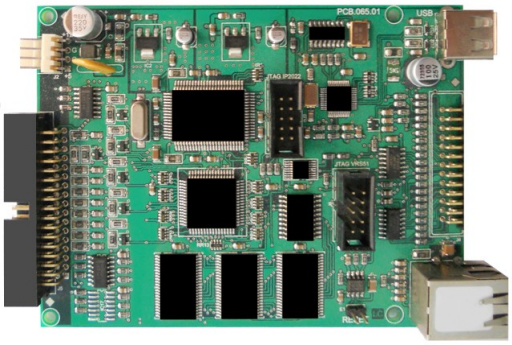
Section 1. DATASHEET





DIMENSIONS	
Height [H]	1" = 2,5 cm
Width [W]	4" = 10,2 cm
Depth [D]	5,3" = 13,5 cm
Weight	0,14 Kg
HARDWARE	
Internal Memory Type	1.5 MB **FRAM** non-volatile memory
Internal Memory Reliability	10^{14} R/W cycles = 438.000 h = 50 years
User Interface	USB keys with FAT format 100 Floppy Disks (00-99)
Power On Time	Less than (<) 500 ms
Floppy Interface	34 pin flat cable (3.5" & 5.25") + 5V power supply 26 pin flat cable (integrated power supply) 26 pin slim cable (integrated power supply)
SOFTWARE	
FIRMWARE RELEASE	Revision 24 (August 2012)
FLOPPY CONFIGURATION	Jumperfree / Plug'n'Play – loading USB key
USER ACCESS & PROTECTION	Jumperfree / Plug'n'Play – loading USB key
FIRMWARE UPGRADE SUPPORT	Plug'n'Play – loading USB key
EMULATION SUPPORT	*Any drive geometry* (*Tr*/*He*/*Se*/*Bytes*) **TRACKS** x Disk = 01 ÷ 82 **HEADS** x Disk = 01 ÷ 02 **SECTORS** x **TRACK** = 01 ÷ 36 **BYTES** x **SECTOR** = 128 ÷ 4096

EMUFDD Tech-Homepage :
www.embeddedsw.net

Designer & Customer Support :
oliboni@embeddedsw.net

EMUFDD Product-Homepage :
www.milosrl.it

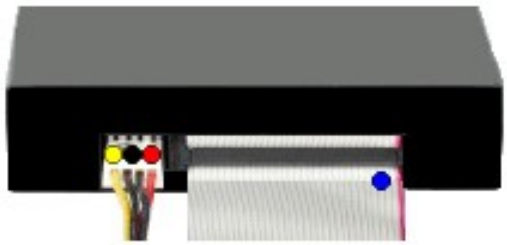
Manufacturer & Purchasing :
claudio.zampieri@milosrl.it

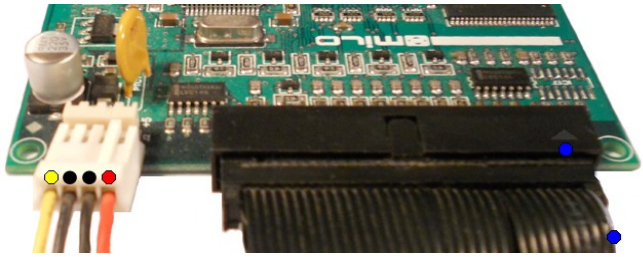
All-inclusive professional installation service available

Floppy disk total configurability: *Encoding, Rotation speed and drive geometry*.

ENCODING	FM 125 KHz – 300 rpm	MFM 250 KHz – 300 rpm
	FM 150 KHz – 360 rpm	MFM 300 KHz – 360 rpm
	FM 250 KHz – 300 rpm	MFM 500 KHz – 300 rpm
	FM *custom* 125 ÷ 250 KHz	MFM *custom* 250 ÷ 500KHz
FAT SUPPORT	Softwareless Mode: 360 KB / 720 KB / 1.200 MB / 1.440 MB	
SOME COMMON EXAMPLES...	82/2/18x512 – MFM: 500 KHz – 300 rpm – 1.476 MB 81/2/18x512 – MFM: 500 KHz – 300 rpm – 1.441 MB 80/2/18x512 – MFM: 500 KHz – 300 rpm – 1.440 MB 80/2/15x512 – MFM: 500 KHz – 360 rpm – 1.200 MB 80/2/9x512 – MFM: 250 KHz – 300 rpm – 720 KB 80/2/9x512 – MFM: 300 KHz – 360 rpm – 720 KB 40/2/9x512 – MFM: 250 KHz – 300 rpm – 360 KB	
MORE LESS COMMON EXAMPLES...	80/2/8x1024 – MFM: 500 KHz – 300 rpm – 1.280 MB 80/2/32x256 – MFM: 500 KHz – 300 rpm – 1.280 MB 80/2/26x256 – MFM: 500 KHz – 300 rpm – 1.040 MB 80/2/5x1024 – MFM: 250 KHz – 300 rpm – 800 KB 80/2/18x256 – MFM: 250 KHz – 300 rpm – 720 KB 80/2/16x256 – MFM: 250 KHz – 300 rpm – 640 KB	
OLD & RARE EXAMPLES...	80/2/2x4096 – MFM: 500 KHz – 300 rpm – 1.280 MB 80/2/4x2048 – MFM: 500 KHz – 300 rpm – 1.280 MB 80/2/5x1024 – FM: 250 KHz – 300 rpm – 800 KB 80/2/9x512 – FM: 250 KHz – 300 rpm – 720 KB 80/2/18x256 – FM: 250 KHz – 300 rpm – 720 KB 80/2/32x128 – FM: 250 KHz – 300 rpm – 640 KB 80/2/18x128 – FM: 125 KHz – 300 rpm – 360 KB 80/2/16x128 – FM: 125 KHz – 300 rpm – 320 KB	
NEED MORE?	*Ask customer support for help in identifying your floppy disk!*	

Section 2. HARDWARE INSTALLATION





EMUFDD installation works like any other real floppy drive installation:

- 2.1) connect the power supply;

🟡	=	+12V power supply (not connected)	**Optional**
⚫	=	two GND lines (joined, connect one or both)	**Required**
🔴	=	+5V power supply	**Required**

- 2.2) connect the 34pin flat cable.

🔵	=	pin-1 mark (flat cable / connector)

⚠ **Be sure to match the connector pin-1 mark with the flat cable pin–1 mark !**

⚠ **Sometimes flat cables are inverted. Please check whether the cable is coloured/marked at pin-1 (standard) or pin-34 (inverted) !**

No system driver or additional software needs to be installed on the host system.

Section 3. INTRODUCTION & EMULATION CYCLE

EMUFDD is equipped with 1.5 MB of internal **FRAM** non-volatile memory:

- **no need** to keep the USB key plugged in;
- top-quality data storage and memory **reliability** (10^{14} read/write cycles);
- **unlimited** permanent internal memory (no battery, fully RoHS).

More than 50 years of non-stop read/write emulation at full speed.

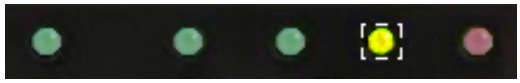
Each EMUFDD can be used by different users with different skills:

- **normal** users can be allowed to load-only floppy disks (playback);
- **advanced** users can have full access to the program floppy disks;
- special floppy disks can be **permanently** write protected;
- **simplified** access available: 1 USB key = 1 floppy disk.

Just ask for your version, fully customized for your everyday's usage !

At power-on EMUFDD immediately (less than 500ms) begins its emulation cycle:

- the emulation engine waits for reading or writing requests from the host system, and any read/write floppy disk access will turn the ACT_LED on;

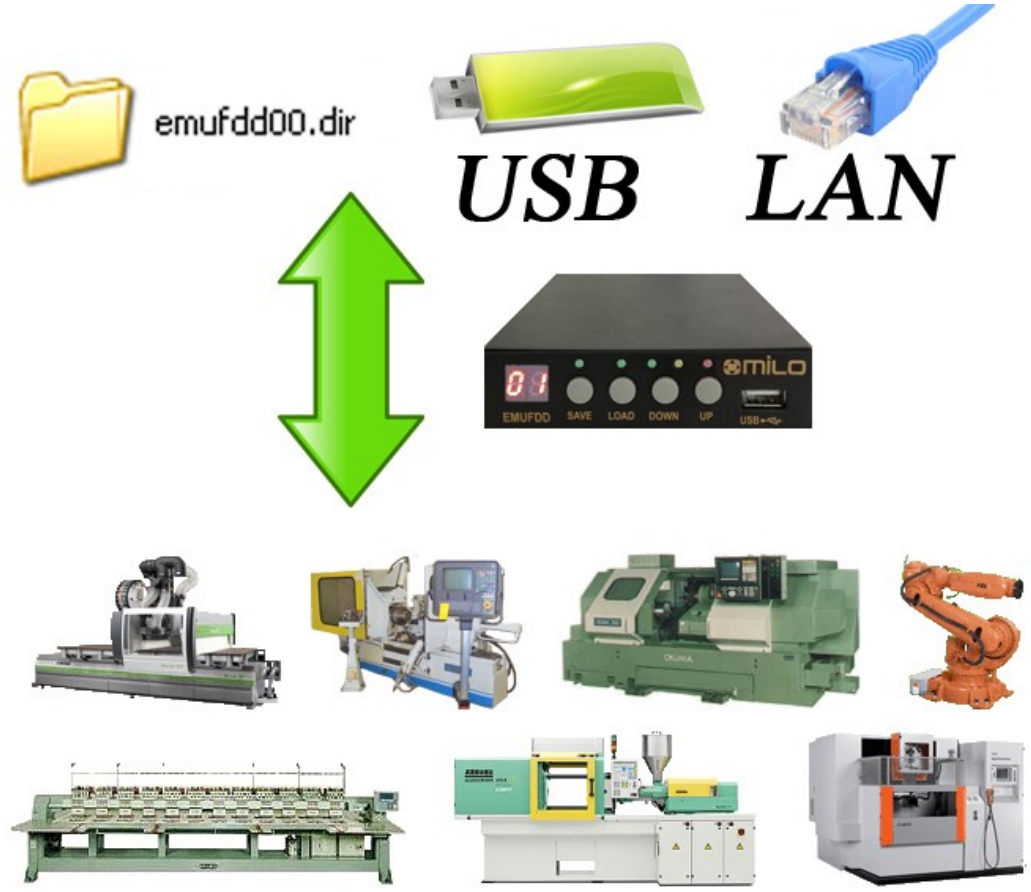


- the display continuously shows the On-Line sequence: **[–]** / **[–]** / **[NN]**, where NN is the current floppy disk number, (from **00** to **99**).

Snapshot of a display On-Line sequence (*NN = 01*).

Section 4. SOFTWARELESS MODE STORAGE

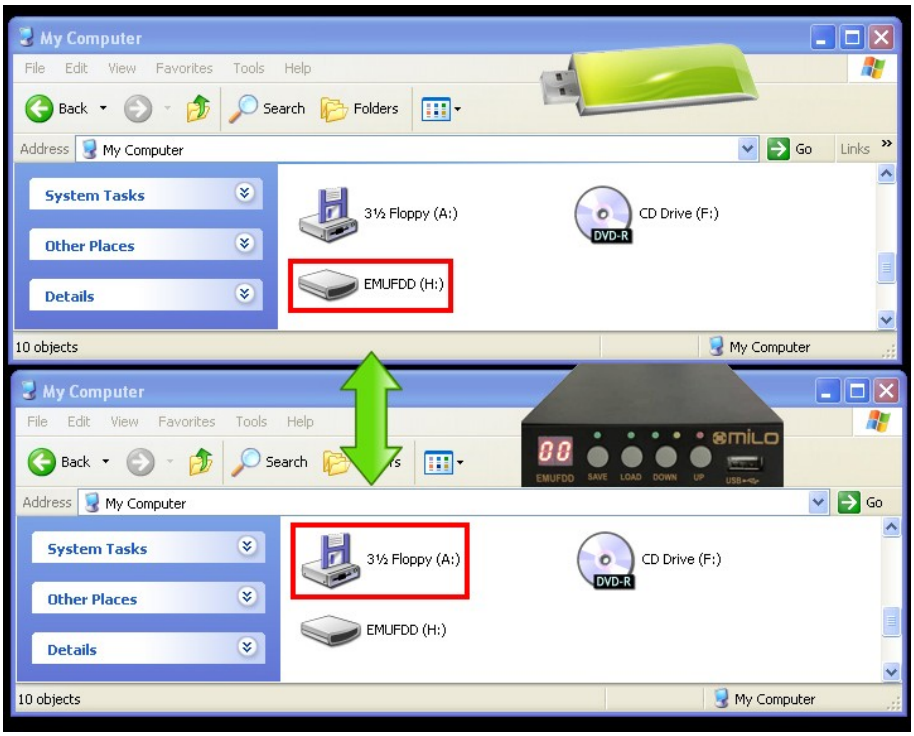
Data can be loaded/saved into/from EMUFDD's memory using any USB key. No special software or partitioning is needed to access and copy'n'paste all the floppy disks. The softwareless mode, a.k.a. "**Translation**", splits all the floppy disks into subdirectories and each "**emufddNN.dir**" subdirectory (**NN** from **00** to **99**) will be handled as the root of a different floppy disk:



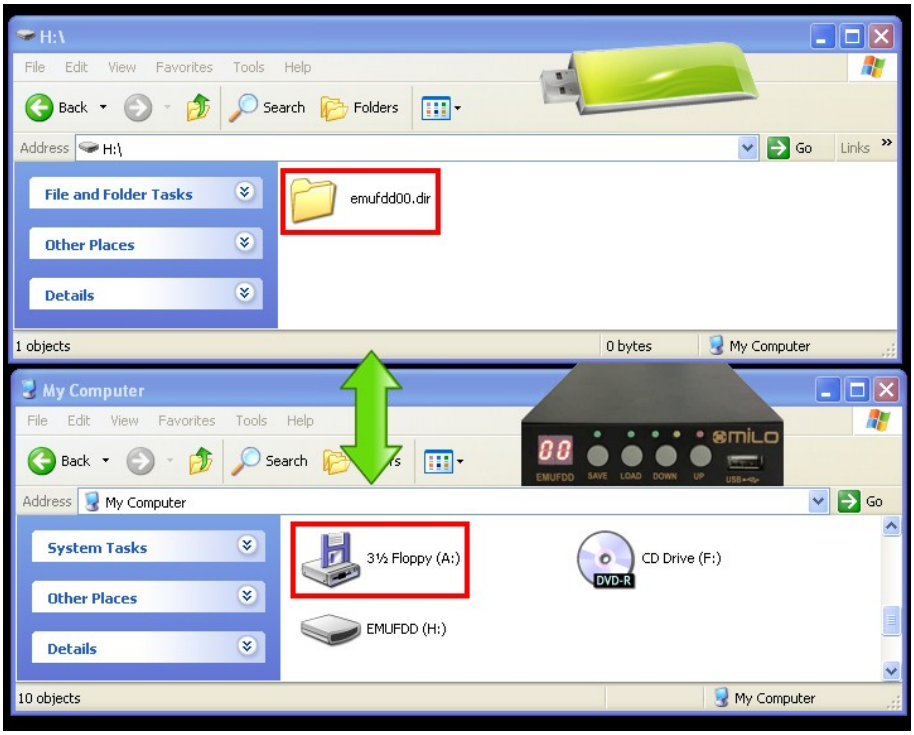
USB key	↔	**EMUFDD (floppy NN)**
X:\emufddNN.dir\dir1\file1.ext	↔	A:\dir1\file1.ext
X:\emufddNN.dir\dir2\file2.ext	↔	A:\dir2\file2.ext
X:\emufddNN.dir\file3.ext	↔	A:\file3.ext
X:\emufddNN.dir\file4.ext	↔	A:\file4.ext
...		...

The translation feature:

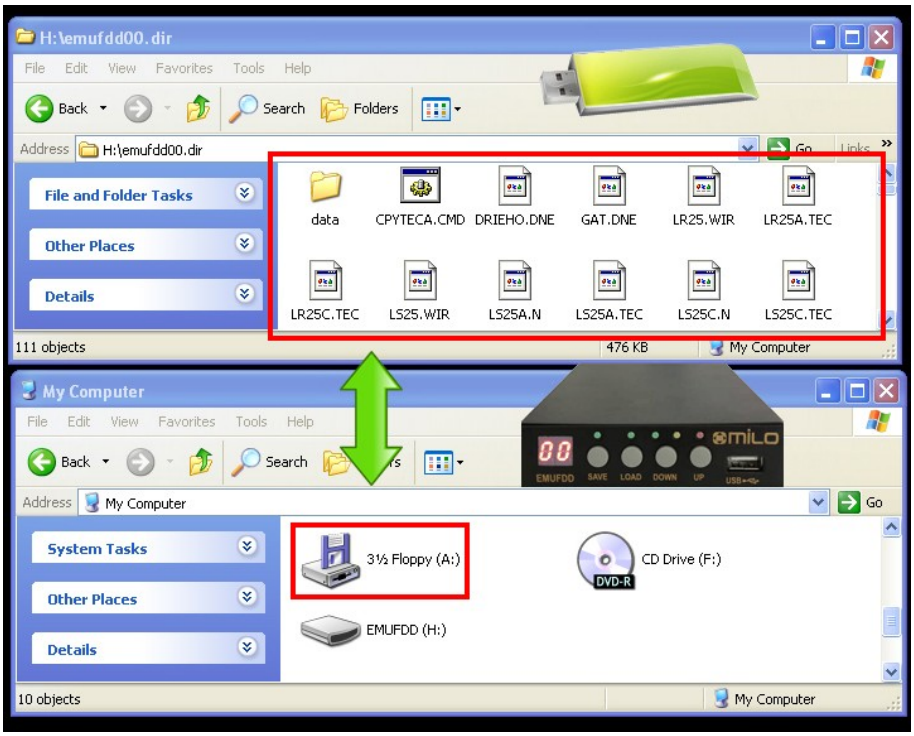
- is available for 360 KB, 720 KB, 1.200 MB, 1.440 MB floppy disks;
- is available for both loading and saving;
- will truncate filenames to 8+3 short form (Longname.ext → longna~1.ext);
- can be enabled/disabled at anytime without reconfiguring (SECTION 11).



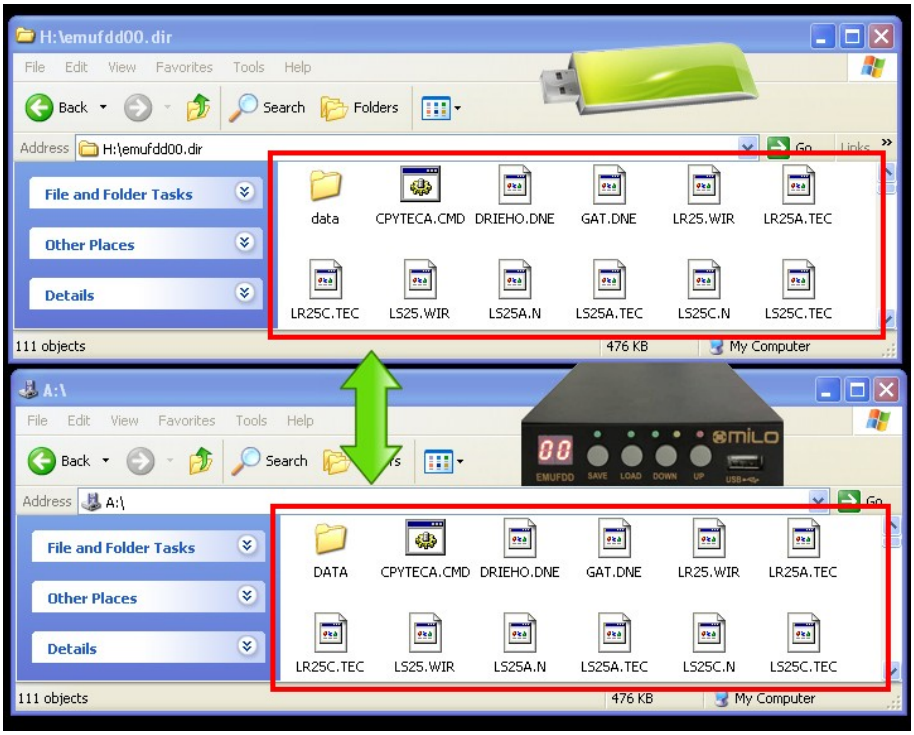
[*top window*] USB key (H:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery



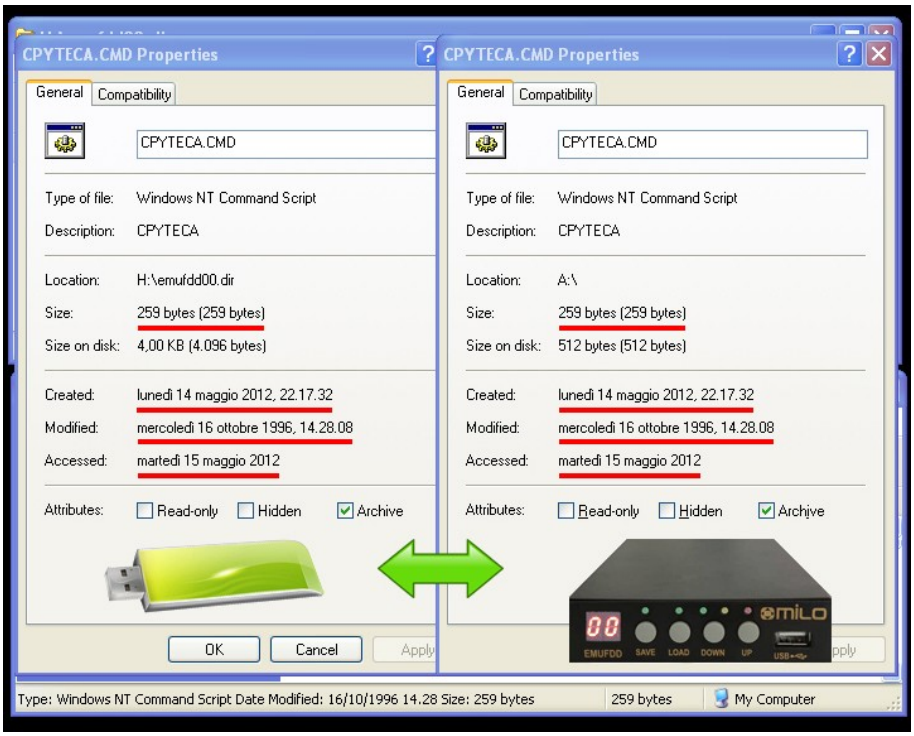
[*top window*] USB key (H:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery



[*top window*] USB key (H:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery



[*top window*] USB key (H:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery



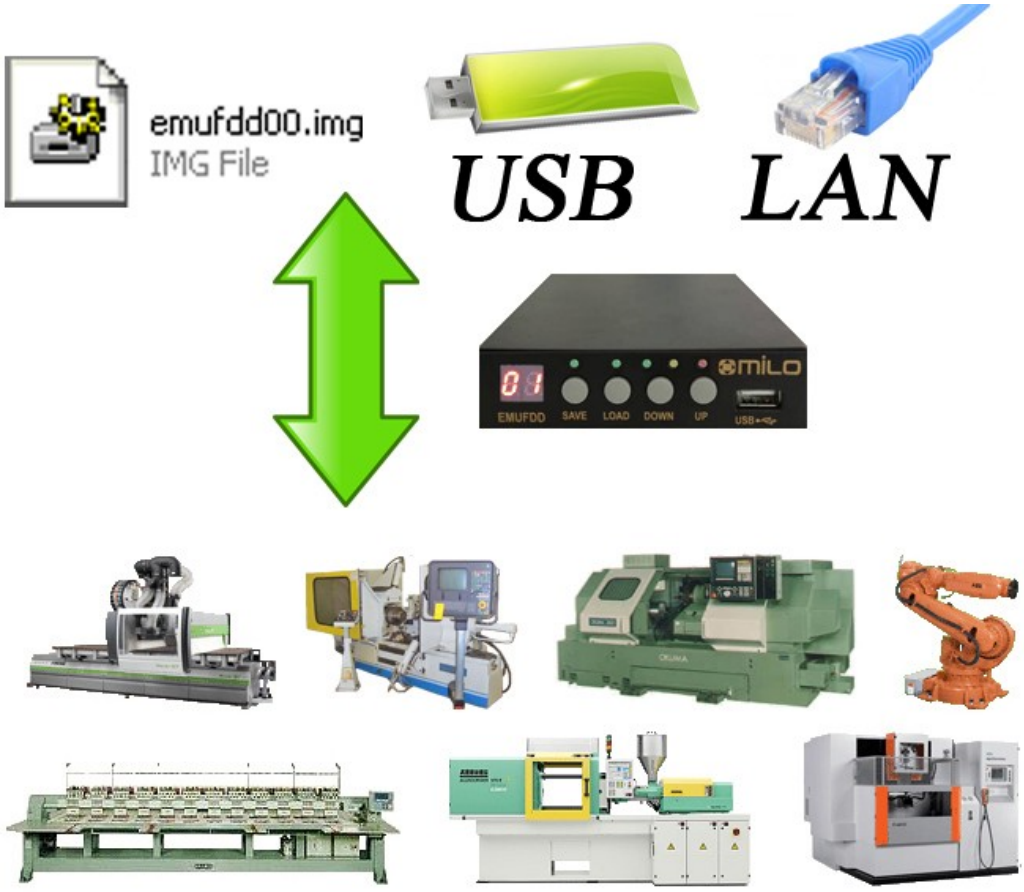
[*top window*] USB key (H:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery

A diff between the original **disk#00** in the USB key (H:\emufdd00.dir\cpyteca.cmd) and its "translated" version by EMUFDD (A:\cpyteca.cmd) shows that there's no high-level difference in the directory structure and the attributes of each file:

Name / **Size** / **Creation time** / **Modify time** / **Access time**

Section 5. VIRTUAL-FLOPPY MODE STORAGE

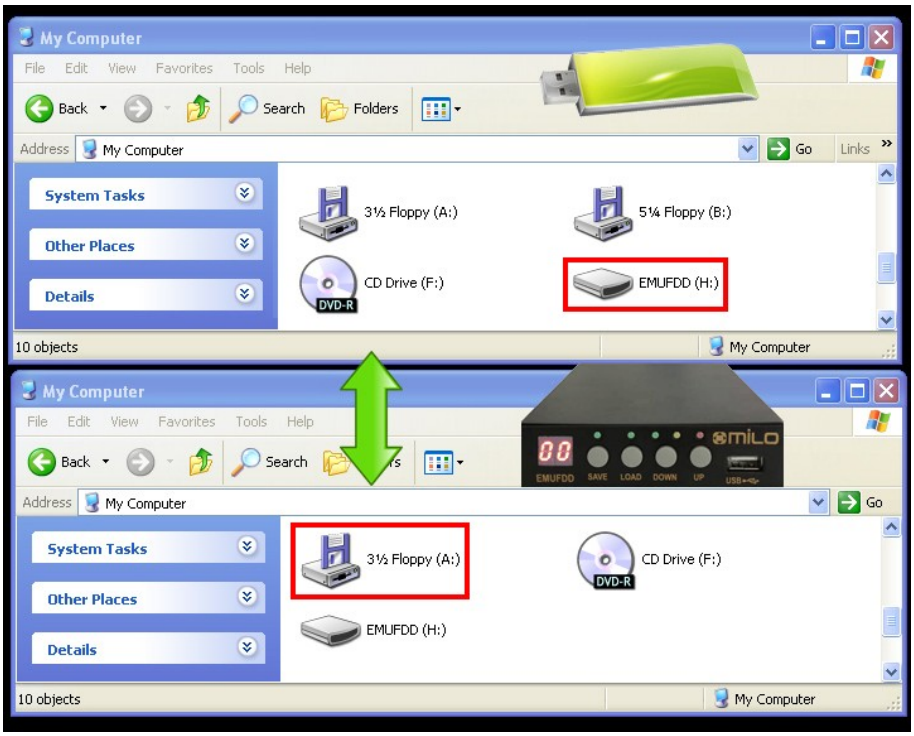
Data can be loaded/saved into/from EMUFDD's memory using any USB key. No special software or partitioning is needed to copy'n'paste all the floppy disks. The virtual-floppy mode, a.k.a. "**ISO FLOPPY IMAGE FILES**", splits all the floppy disks into image files (mounted on any PC using free software VFD) and each "**emufddNN.img**" file (**NN** from **00** to **99**) will be handled as the low-level snapshot of a different floppy disk:



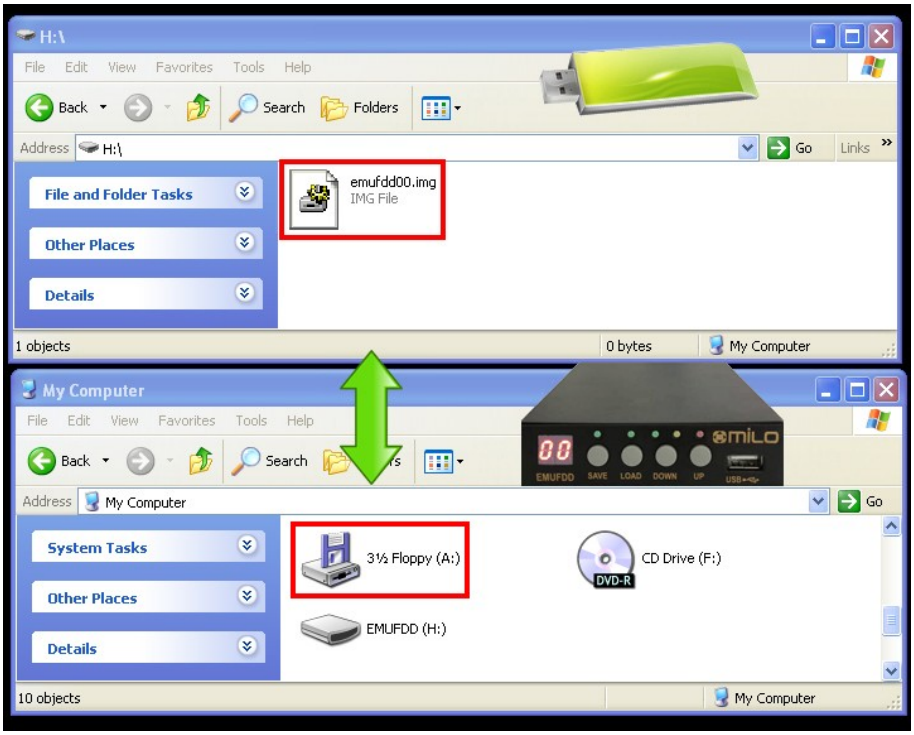
USB key	↔	**EMUFDD (floppy NN)**
X:\emufddNN.img	↔	<floppy> track0/side0/sector1
	↔	<floppy> track0/side0/sector2
		...

Virtual-Floppy image files:

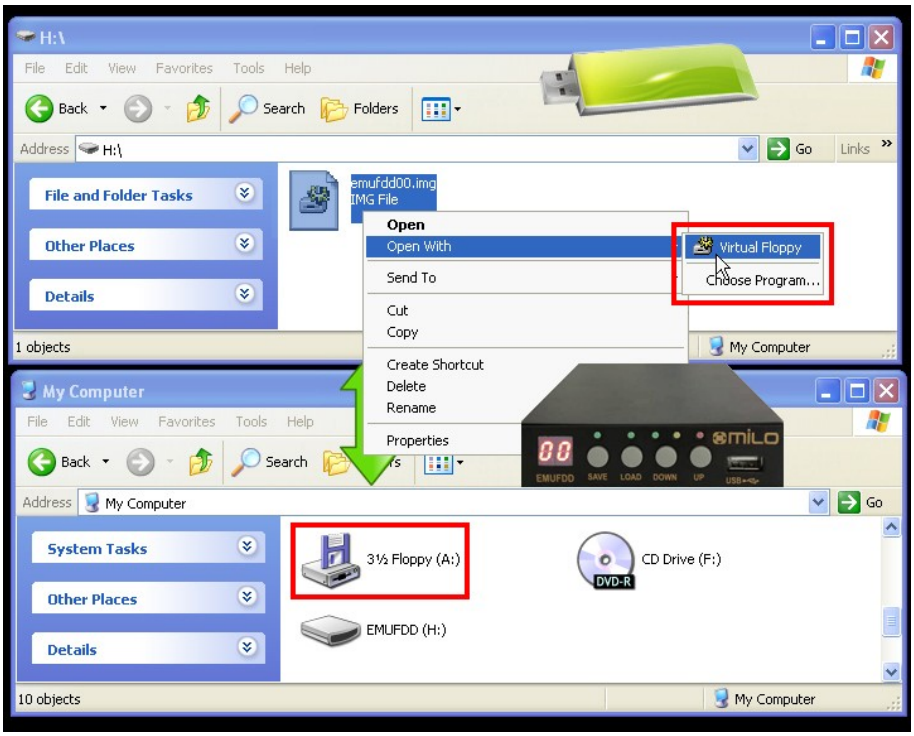
- are available for both loading and saving;
- are a low-level snapshot of the floppy disk surface;
- allow unlimited emulation of any floppy disk (system, bootable, custom, …);
- can be directly mounted as virtual floppy drives by free software VFD;
- can be directly imported as backups of real floppies by free software OmniFlop;
- can be enabled/disabled at anytime without reconfiguring (**SECTION 11**).



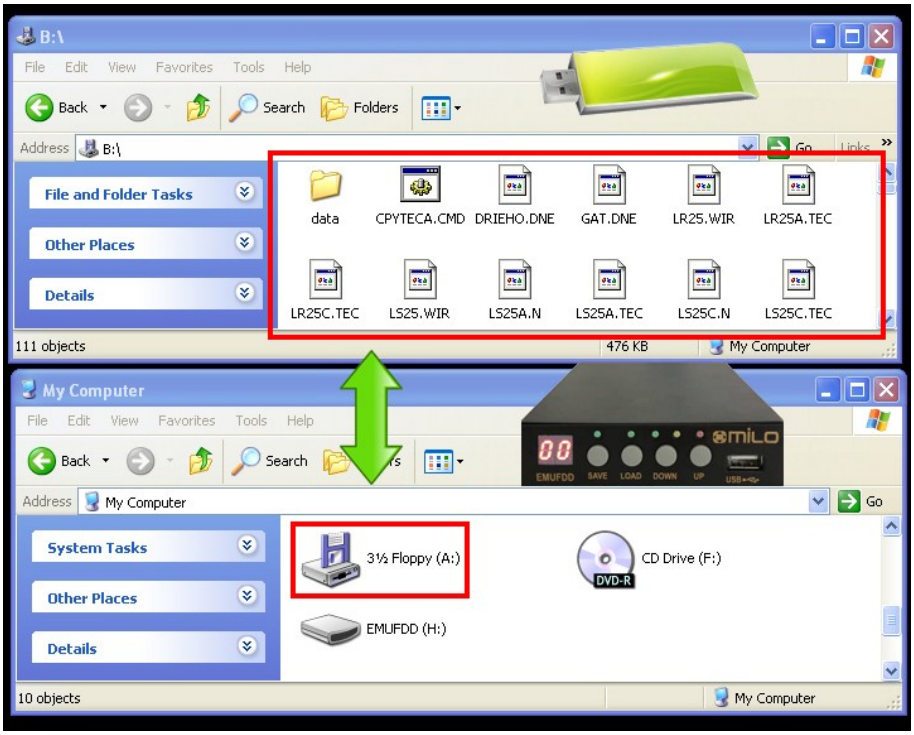
[*top window*] USB key (H:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery



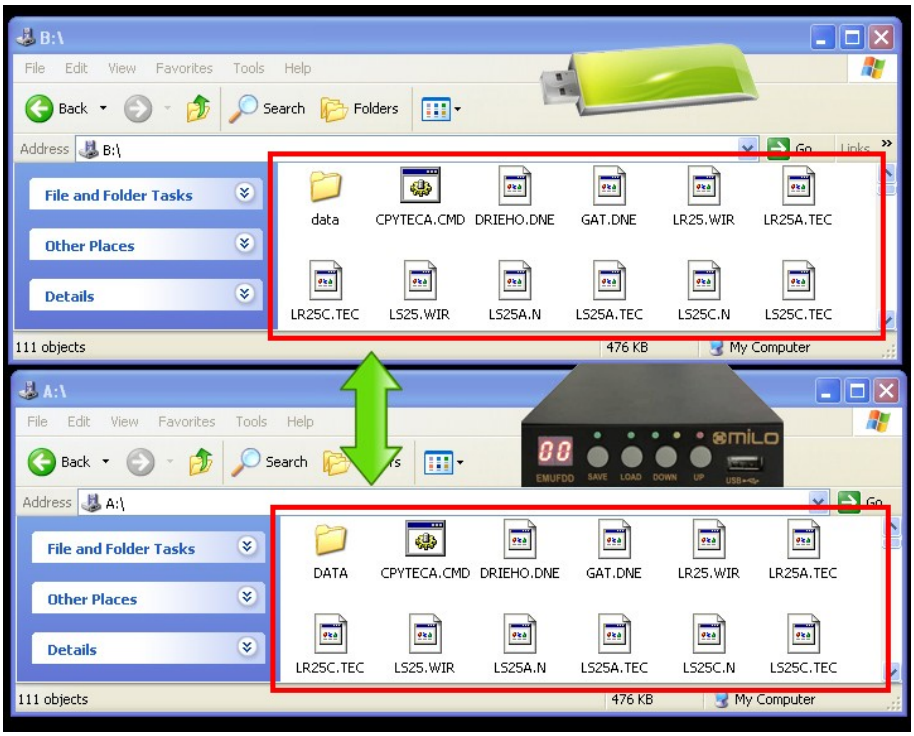
[*top window*] USB key (H:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery



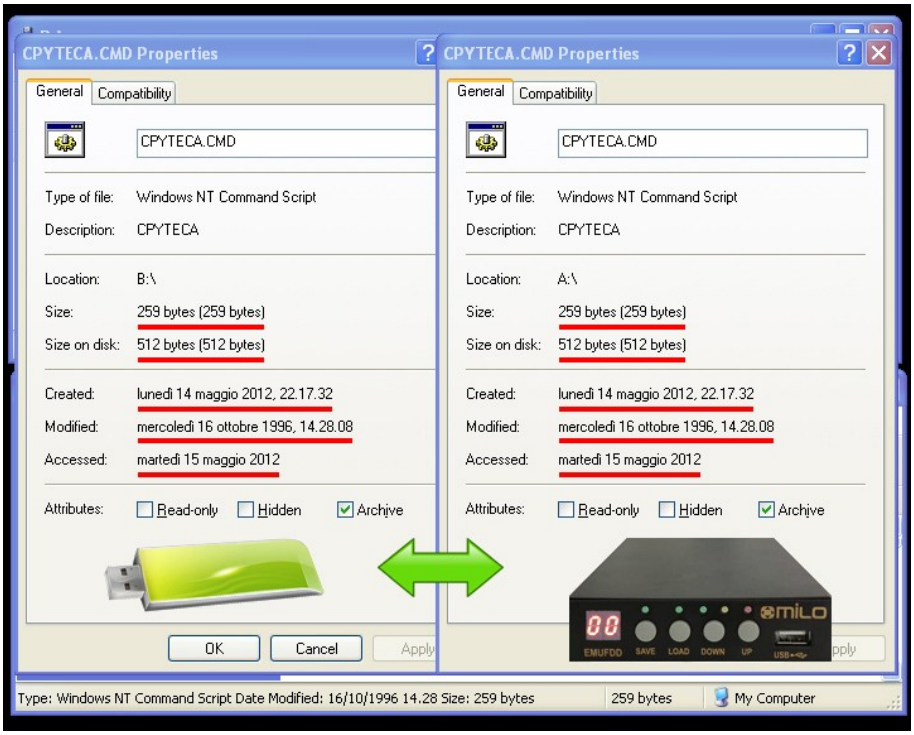
[*top window*] USB key (H:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery



[*top window*] USB key (H:) + VFD (B:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery



[*top window*] USB key (H:) + VFD (B:) in the pc/server
[*bottom window*] EMUFDD (A:) in the machinery


CPYTECA.CMD Properties
General Compatibility
CPYTECA.CMD
Type of file: Windows NT Command Script
Description: CPYTECA
Location: B:\
Size: 259 bytes (259 bytes)
Size on disk: 512 bytes (512 bytes)
Created: lunedì 14 maggio 2012, 22.17.32
Modified: mercoledì 16 ottobre 1996, 14.28.08
Accessed: martedì 15 maggio 2012
Attributes: Read-only Hidden Archive
OK Cancel Apply
CPYTECA.CMD Properties
General Compatibility
CPYTECA.CMD
Type of file: Windows NT Command Script
Description: CPYTECA
Location: A:\
Size: 259 bytes (259 bytes)
Size on disk: 512 bytes (512 bytes)
Created: lunedì 14 maggio 2012, 22.17.32
Modified: mercoledì 16 ottobre 1996, 14.28.08
Accessed: martedì 15 maggio 2012
Attributes: Read-only Hidden Archive
miLo
EMUFDD SAVE LOAD DOWN UP
Type: Windows NT Command Script Date Modified: 16/10/1996 14.28 Size: 259 bytes
259 bytes My Computer

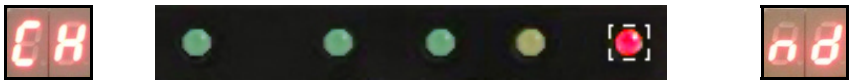
A diff between the original **disk#00** in the USB key (B:\cpyteca.cmd) and its "translated" version by EMUFDD (A:\cpyteca.cmd) shows that there's no high-level and low-level difference in the directory structure and the attributes of each file:

Name / Size / Size on disk / Creation time / Modify time / Access time

Section 6. LOADING INTO EMUFDD'S MEMORY FROM USB

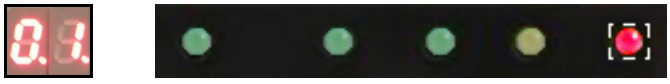
- 6.1) plug the USB key in and go Off-Line: press LOAD;

- 6.2) OFF-LINE_LED turns on and the display shows **[CH]** while *checking* the USB key for floppy image files (and subdirectories, if translation is on). Should *no USB device* be plugged in, the displays shows **[nd]** and EMUFDD switches automatically back to On-Line mode;



- 6.3) the display shows the current floppy number. Select the floppy to be loaded changing the current number (short DOWN/UP pressure = –1/+1, long DOWN/UP pressure = fast rewind/forward). Missing floppies are shown as **[NN]**, existing floppies are shown as **[N.N.]**.
  Only existing floppies can be loaded, pressing LOAD;

- 6.4) the display, while *loading*, shows **[LO]** and LOAD_LED / ACT_LED turn on, until loading end. Any loading *error* immediately stops loading and display shows **[Er]**. Successful loading ends with display showing again current floppy number and LOAD_LED / ACT_LED turned off;



Plugging the USB key off while loading will not damage the USB key but will force EMUFDD to reset with an inconsistent internal memory !

- 6.5) being no button pressed, after 5 seconds, EMUFDD automatically switches back to On-Line mode. Feel free to plug the USB key safely off.

Loading completely/partially overwrites EMUFDD's internal memory. The previous floppy data, if not saved before loading, can't be recovered !

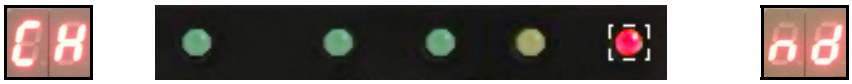
CLICK HERE FOR A VIDEO-DEMO: LOADING INTO INTERNAL MEMORY FROM USB

Load + Save can be used to create, without using a PC, multiple copies of an existing floppy on the USB key. For example: load NN and save it as NN+1, NN+2, NN+3, ...

Section 7. SAVING FROM EMUFDD'S INTERNAL MEMORY TO USB

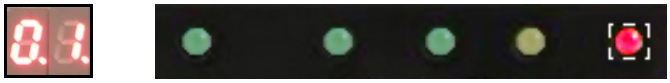
- 7.1) plug the USB key in and go Off-Line: press SAVE;

- 7.2) OFF-LINE_LED turns on and the display shows **[CH]** while *checking* the USB key for floppy image files (and subdirectories, if translation is on). Should *no USB device* be plugged in, the displays shows **[nd]** and EMUFDD switches automatically back to On-Line mode;



- 7.3) the display shows the current floppy number. Select the floppy to be saved changing the current number (short DOWN/UP pressure = –1/+1, long DOWN/UP pressure = fast rewind/forward). Missing floppies are shown as **[NN]**, existing floppyies are shown as **[N.N.]**.
  Both missing and existing floppies can be saved, pressing SAVE (missing ones are created, existing ones are overwritten);

- 7.4) the display, while *saving*, shows **[SA]** and SAVE_LED / ACT_LED turn on, until saving end. Any saving *error* immediately stops saving and display shows **[Er]**. Successful saving ends with display showing again current floppy number and SAVE_LED / ACT_LED turned off;



Plugging the USB key off while saving will damage the USB key. Plug the USB key off only after the OFF-LINE_LED (red) turns off !

- 7.5) being no button pressed, after 5 seconds, EMUFDD automatically switches back to On-Line mode. Feel free to plug the USB key safely off.

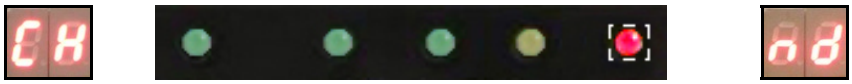
CLICK HERE FOR A VIDEO-DEMO: SAVING FROM INTERNAL MEMORY TO USB

Load + Save can be used to create, without using a PC, multiple copies of an existing floppy on the USB key. For example: load NN and save it as NN+1, NN+2, NN+3, ...

Section 8. FORMATTING EMUFDD'S INTERNAL MEMORY AND USB

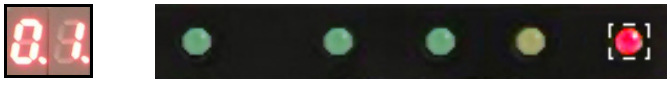
- 8.1) plug the USB key in and go Off-Line: press SAVE;

- 8.2) OFF-LINE_LED turns on and the display shows **[CH]** while *checking* the USB key for subdirectories (format is allowed only when translation is on). Should *no USB device* be plugged in, the displays shows **[nd]** and EMUFDD switches automatically back to On-Line mode;



- 8.3) the display shows the current floppy number. Select the floppy to be formatted changing the current number (short DOWN/UP pressure = –1/+1, long DOWN/UP pressure = fast rewind/forward). Missing floppies are shown as **[NN]**, existing floppyies are shown as **[N.N.]**.
Both missing and existing floppies can be formatted pressing SAVE+LOAD (missing ones are created, existing ones are overwritten);

- 8.4) the display, while *formatting*, shows **[FO]** and SAVE_LED / LOAD_LED / ACT_LED turn on, until formatting end. Any formatting *error* immediately stops formatting and display shows **[Er]**. Successful formatting ends with display showing again current floppy number and SAVE_LED / LOAD_LED / ACT_LED turned off;



Plugging the USB key off while formatting will both damage the USB key and force EMUFDD to reset with an inconsistent internal memory. Plug the USB key off only after the OFF-LINE_LED (red) turns off ! !

- 8.5) being no button pressed, after 5 seconds, EMUFDD automatically switches back to On-Line mode. Feel free to plug the USB key safely off.

CLICK HERE FOR A VIDEO-DEMO: FORMATTING INTERNAL MEMORY AND USB

Format is allowed only in softwareless mode (when translation is on) Check the supported formats (**SECTION 4**).

Section 9. LOADING A CONFIGURATION

EMUFDD configuration is plug'n'play and absolutely jumper-free. It's also possible to configure the emulator with up to 100 different configurations and switch, at run-time, between them. The first 10 configurations (c0÷c9) can be loaded with any custom setting, the other 90 configurations (0.0÷9.0) are fixed presets.

- 9.1) load a valid **EMUFDD.CFG** file into a USB key;

Configuration files for any machinery/floppy drive/floppy disk will be provided for free, only after purchasing, writing to the customer support (*Eng. Cosimo Oliboni, 7/7 direct line with the designer of EMUFDD*) *at* **oliboni@embeddedsw.net**

- 9.2) plug the USB key in and go Off-Line: press LOAD;

- 9.3) the device will auto-reset (all leds blink very fast) and the display, while *changing configuration*, shows **[cc]**. Any configuration *error* immediately stops auto-reset and display shows **[Er]**;

- 9.4) load a valid floppy into memory (SECTION 6) or, if format is supported, format EMUFDD's memory (SECTION 8).

Section 10. SWITCHING CONFIGURATION

- 10.1) with no USB key plugged in press SAVE+DOWN+UP;

- 10.2) select the new configuration (NN = c0÷c9, 0.0÷9.0) changing the current number (DOWN/UP pressure = –1/+1). Missing configurations are shown as **[cN]**, existing configurations are shown as **[c.N]** and **[N.N]**.
  Only existing configurations can be loaded, pressing SAVE+LOAD;

- 10.3) the device will auto-reset (all leds blink very fast) and the display, while *changing configuration*, shows **[cc]**;

- 10.4) load a valid floppy into memory (SECTION 6) or, if format is supported, format EMUFDD's memory (SECTION 8).

Example 1: Your device needs two (*or more*) *different kinds of floppy disks. Base configuration* (**c0**) *is assigned to the boot disk, the following ones* (**c1**/**c2**/...) *are assigned to user programs with different formats* (720 KB, 800 KB, 1.440 MB, ...).

- device is powered up;
- user selects base configuration and loads the boot image;
- user selects another configuration and loads/saves user programs;

c0 (BOOT) **c1** (720 KB) **c2** (800 KB)

Example 2: You own two (or more) different devices and always need to use only one of them at a time. Each device is assigned a configuration and you buy only 1 EMUFDD.

- EMUFDD is connected to device-N and, after that, device-N is powered up;
- user selects configuration-N and loads/saves user programs;
- device-N is shut down and EMUFDD disconnected;

c0 (DEVICE-0) **c1** (DEVICE-1) **cN** (DEVICE-N)

Click here for a video-demo: Switching configuration #00 / #89
Click here for a video-demo: Switching configuration #89 / #00

Section 11. SOFTWARELESS MODE ON/OFF

The softwareless mode translation feature (SECTION 4) can be enabled/disabled at anytime without reconfiguring the device.

- 11.1) with no USB key plugged in press SAVE+UP;
- 11.2) the current translation configuration is shown as **[tN]** (N = 0/1 = disabled/enabled). Pressing SAVE+UP again causes the translation configuration to switch;

- 11.3) the device will auto-reset (all leds blink very fast) and the display shows the new *translation* configuration **[tN].**

CLICK HERE FOR A VIDEO-DEMO: SETTING TRANSLATION ON
CLICK HERE FOR A VIDEO-DEMO: SETTING TRANSLATION OFF

Section 12. AUTOSAVE ON/OFF

The AutoSave option has been added to simplify EMUFDD everyday's usage. When AutoSave is enabled, you don't need to manually save the current work before loading a new floppy or formatting a new one: EMUFDD automatically saves its internal memory to the current working floppy before loading/formatting.

Example:

- *the current working floppy is number X;*
- *machinery has written to the floppy modifying it;*
- *internal memory hasn't been already saved to USB key;*
- *you need to switch to next working floppy Y.*

AutoSave lets you simply plug the USB key in and load the Y working floppy.
EMUFDD saves the current working floppy X automatically.

- 12.1) with no USB key plugged in press SAVE+DOWN;

- 12.2) the current AutoSave configuration is shown as **[AN]** (N = 0/1 = disabled/enabled). Pressing SAVE+DOWN again causes the AutoSave configuration to switch;

- 12.3) the device will auto-reset (all leds blink very fast) and the display shows the new *AutoSave* configuration **[AN].**

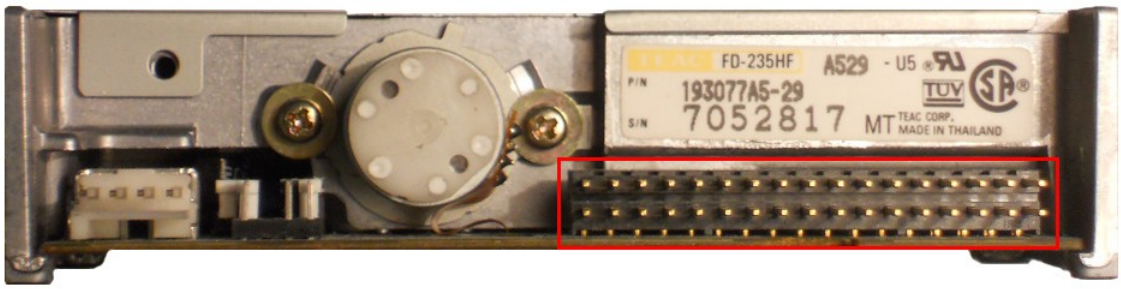
[Click here for a video-demo: Setting AutoSave ON]
[Click here for a video-demo: Setting AutoSave OFF]

Appendix A. Floppy Disk Drive Interfaces

Floppy drive configurability: *34pin host interface*.

Pin	Dir	Signal		
		(PC)	(NC)	(Custom)
2	Out	Density Select	Disk Change	0 (GND) / 1 (+5V) Disk Change / Ready
4	-	*Not connected*	*Not connected*	*Not connected*
6	-	*Not connected*	*Not connected*	*Not connected*
8	Out	Index Hole	Index Hole	Index Hole
10	In	Motor A	Drive 0	Pin 10
12	In	Drive B	Drive 1	Pin 12
14	In	Drive A	Drive 2	Pin 14
16	In	Motor B	Motor	Pin 16
18	In	Step Dir	Step Dir	Step Dir
20	In	Step Pulse	Step Pulse	Step Pulse
22	In	Write Data	Write Data	Write Data
24	In	Write Enable	Write Enable	Write Enable
26	Out	Track 0	Track 0	Track 0
28	Out	Write Protect	Write Protect	Write Protect
30	Out	Read Data	Read Data	Read Data
32	In	Head Select	Head Select	Head Select
34	Out	Disk Change	Ready	0 (GND) / 1 (+5V) Disk Change / Ready
1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33 = GND				

The 34pin interface is natively supported by EMUFDD.

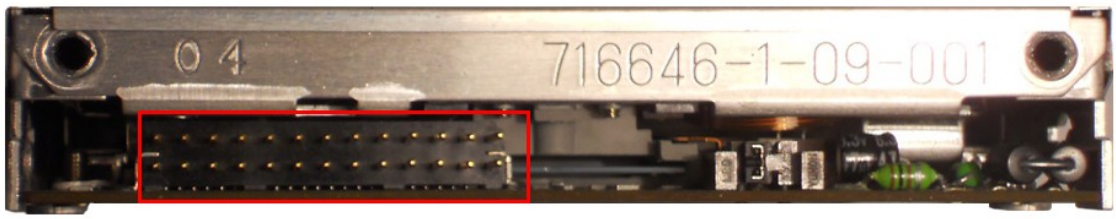


Example: 34pin host interface (TEAC FD-235HF-A529).

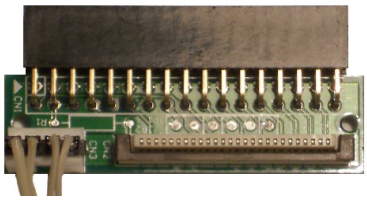
Floppy drive configurability: *26pin host interface.*

PIN	DIR	SIGNAL
2	Out	Index Hole
4	In	Drive Sel
6	Out	Disk Change
8	Out	Ready
10	In	Motor
12	In	Step Dir
13	Out	Density Select
14	In	Step Pulse
16	In	Write Data
18	In	Write Enable
20	Out	Track 0
22	Out	Write Protect
24	Out	Read Data
26	In	Head Select
1,3,5 = +5V 7,9,13,15,17,19,21,23,25 = GND		

The 26pin interface, normal & slim pinout, is supported by EMUFDD using an adatper.

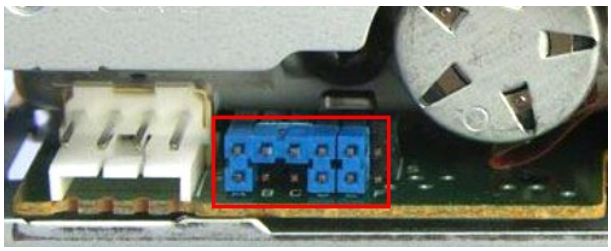


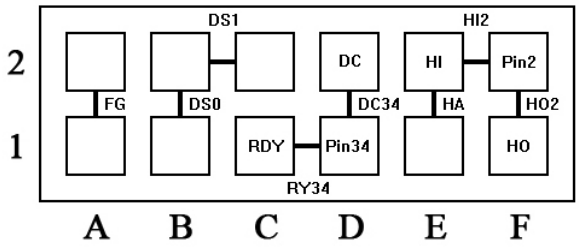
Example: 26pin host interface (NEC FD1138C) – *normal pinout.*



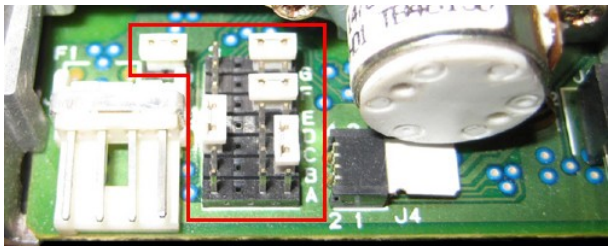
Example: 34pin-to-26pin slim adapter.

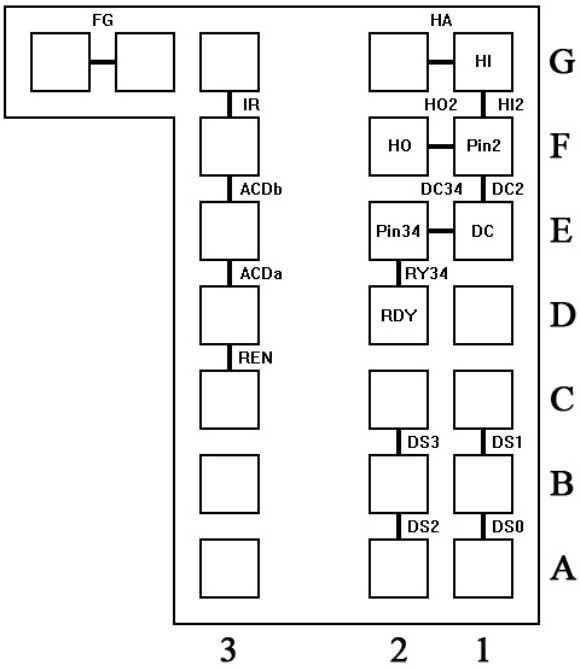
Appendix B. TEAC Floppy Drives Jumpering



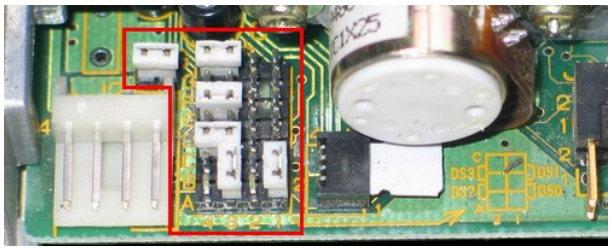


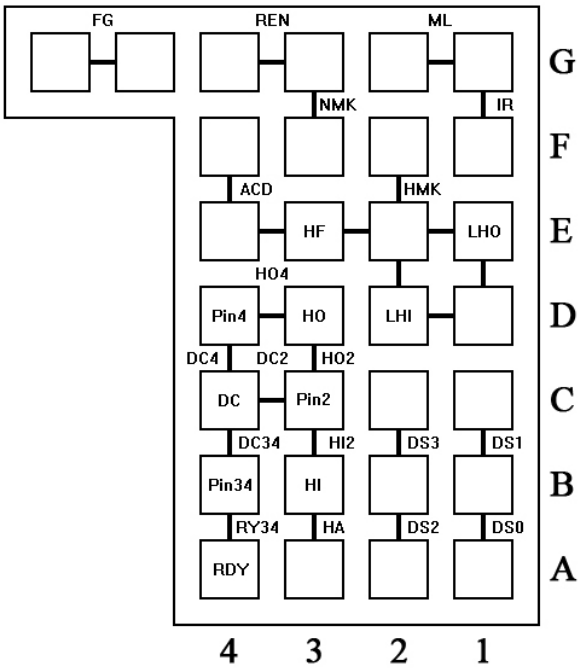
A1-A2	**FG**	Short between FDD frame and DC 0V	
B1-B2	**DS0**	Drive select 0	(NC) Drive0
B2-C2	**DS1**	Drive select 1	(NC) Drive1
C1-D1	**RY34**	Ready output on Pin 34	Pin34 = Ready
D1-D2	**DC34**	Disk Change output on Pin 34	Pin34 = Disk Change
E1-E2	**HA**	Density set automatically	Pin02 = Disk Change
E2-F2	**HI2**	Density set by HD IN on pin 2	
F1-F2	**HO2**	Density (HD OUT) output on pin 2	Pin02 = Density Select





FG	**FG**	Short between FDD frame and DC 0V	
A1-B1	**DS0**	Drive select 0	(NC) Drive0
B1-C1	**DS1**	Drive select 1	(NC) Drive1
A2-B2	**DS2**	Drive select 2	(NC) Drive2
B2-C2	**DS3**	Drive select 3	(NC) Drive3
C3-D3	**REN**	Disable auto-recalibration	
D3-E3	**ACD(a)**	Disable auto-checking	
E3-F3	**ACD(b)**	Disable auto-checking	
D2-E2	**RY34**	Ready output on Pin 34	Pin34 = Ready
E1-E2	**DC34**	Disk Change output on Pin 34	Pin34 = Disk Change
E1-F1	**DC2**	Disk Change output on Pin 2	Pin02 = Disk Change
G1-G2	**HA**	Density set automatically	
F1-G1	**HI2**	Density set by HD IN on pin 2	
F1-F2	**HO2**	Density (HD OUT) output on pin 2	Pin02 = Density Select
F3-G3	**IR**	LED on when: (Drive Select AND Ready)	





FG	**FG**	Short between FDD frame and DC 0V	
A1-B1	**DS0**	Drive select 0	(NC) Drive0
B1-C1	**DS1**	Drive select 1	(NC) Drive1
A2-B2	**DS2**	Drive select 2	(NC) Drive2
B2-C2	**DS3**	Drive select 3	(NC) Drive3
A4-B4	**RY34**	Ready output on Pin 34	Pin34 = Ready
B4-C4	**DC34**	Disk Change output on Pin 34	Pin34 = Disk Change
C3-C4	**DC2**	Disk Change output on Pin 2	Pin02 = Disk Change
C4-D4	**DC4**	Disk Change output on Pin 4	Pin04 = Disk Change
A3-B3	**HA**	Density set automatically	
B3-C3	**HI2**	Density set by HD IN on pin 2	
C3-D3	**HO2**	Density (HD OUT) output on pin 2	Pin02 = Density Select
D3-D4	**HO4**	Density (HD OUT) output on pin 4	Pin04 = Density Select
D1-D2	**LHI**	---or---	
D2-E2	**LHI**	HD IN low is high density	
D1-E1	**LHO**	---or---	
E1-E2	**LHO**	HD IN high is high density	
E2-F2	**HMK**	Half mask for INDEX/READ-DATA	
F3-G3	**NMK**	No mask for INDEX/READ-DATA	
F1-G1	**IR**	LED on when: (Drive Select AND Ready)	
G1-G2	**ML**	Motor on when: (Motor ON AND LED on)	
E4-F4	**ACD**	Disable auto-checking	
G3-G4	**REN**	Disable auto-recalibration	
E2-E3	**HF**	---or---	
E3-E4	**HF**	Must always be in for this version of drive	